

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 30929wopoo	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416).
International Application No. PCT/AU02/00513	International Filing Date (day/month/year) 24 April 2002	Priority Date (day/month/year) 27 April 2001
International Patent Classification (IPC) or national classification and IPC Int. Cl. ⁷ F01B 1/06, 9/06, F02B 75/32, F16H 21/36, 25/14		
Applicant MASLEN, Desmond Jay		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 4 sheets, including this cover sheet.

☒ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 11 sheet(s).

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☒ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☐ Certain observations on the international application

Date of submission of the demand 21 November 2002	Date of completion of the report 6 February 2003
Name and mailing address of the IPEA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaustralia.gov.au Facsimile No. (02) 6285 3929	Authorized Officer KURT TOBLER Telephone No. (02) 6283 2469

I. Basis of the report**1. With regard to the elements of the international application:***

- ☐ the international application as originally filed.
- ☒ the description, pages 1, 4-9, as originally filed,
pages 3, received with the letter of 7 January 2003
pages 2, 2a, received with the letter of 24 January 2003
- ☒ the claims, pages , as originally filed,
pages , as amended (together with any statement) under Article 19,
pages , filed with the demand,
pages 10-11, received with the letter of 24 January 2003
- ☒ the drawings, pages , as originally filed,
pages 1-6, filed with the demand,
pages , received on with the letter of
- ☐ the sequence listing part of the description:
pages , as originally filed
pages , filed with the demand
pages , received on with the letter of

2. With regard to the language, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language which is:

- ☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

3. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

4. ☒ The amendments have resulted in the cancellation of:

- ☐ the description, pages
- ☐ the claims, Nos. 14-24
- ☐ the drawings, sheets/fig.

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).**

* Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).

** Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**1. Statement**

Novelty (N)	Claims 1-13	YES
	Claims	NO
Inventive step (IS)	Claims 1-13	YES
	Claims	NO
Industrial applicability (IA)	Claims 1-13	YES
	Claims	NO

2. Citations and explanations (Rule 70.7)

Claims 1-13 meet the criteria set forth in PCT Article 33(2)-(4) for novelty. The prior art published before the priority date does not disclose a radial engine with a slider block located on a free end of a connecting rod. The claimed invention is not obvious in the light of any of the cited documents nor disclosed in any obvious combination, nor would the claimed invention be obvious to a person skilled in the art in the light of common general knowledge by itself or in combination with any of these documents.

VI. Certain documents cited**1. Certain published documents (Rule 70.10)**

Application No. Patent No.	Publication date (day/month/year)	Filing date (day/month/year)	Priority date (valid claim) (day/month/year)
US 2001/0017122 A1	30 AUGUST 2001	27 FEBRUARY 2001	29 FEBRUARY 2000

2. Non-written disclosures (Rule 70.9)

Kind of non-written disclosure	Date of non-written disclosure (day/month/year)	Date of written disclosure referring to non-written disclosure (day/month/year)
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structures are expensive and difficult to produce and hence are often not suitable for large-scale production.

SUMMARY OF THE INVENTION

It is an object of the present invention to overcome or ameliorate one or more of
5 the disadvantages of the prior art, or to provide a useful alternative.

Accordingly, the invention provides a radial engine including:

- an engine block having a central aperture;
- a drive shaft extending through the aperture;
- a spaced pair of cam plates rotationally fixed with respect to each other, the plates
10 being fixedly mounted on the shaft;
- each cam plate including a planar face, the planar face of one cam plate opposing the planar face of the other cam plate;
- the opposing faces each including a pair of spaced opposing walls defining a substantially "figure 8" shaped continuous loop, the walls on one the face being aligned
15 with the walls on the opposing face;
- at least one cylinder fixed with respect to the block and extending outwardly from the block;
- a reciprocable piston slidably mounted within the cylinder;
- a connecting rod fixedly connected at one end to the piston and having an opposing
20 free end;
- a slider bearing located on the free end of the connecting rod, the slider bearing engaging with a guide for guiding the slider bearing during reciprocation of the piston; and
- a cam follower engaged with the walls of each cam plate, wherein reciprocation of
25 the piston rotates the plates and the drive shaft.

Preferably, the guide for the slider bearing is defined by a radially extending bore in the engine block and sidewalls of the bore laterally support the slider bearing during reciprocation of the piston.

Preferably, the cam follower is a pin. More preferably, the pin is included on a
30 linear slider bearing fixedly connected to the free end of the connecting rod. Even more preferably, the slider bearing includes a prismatic body having an aperture for mounting the pin.

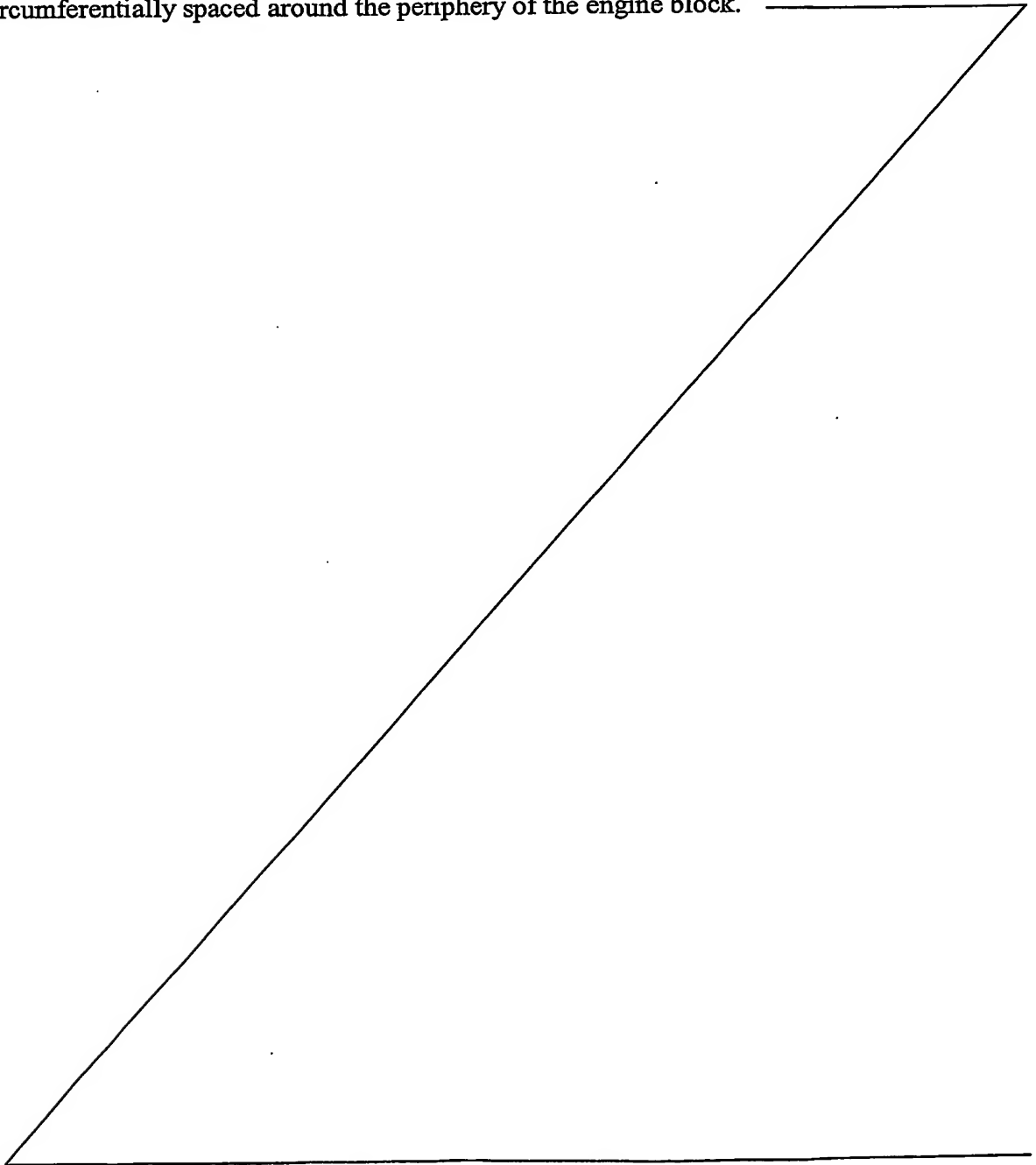
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Preferably each the substantially "figure 8" shaped continuous loop is defined by a groove in each the plate and the cam follower projects into each the groove.

The engine preferably includes a guide for translationally guiding the connecting rod. More preferably, the guide is defined by a complementary bore in the block, the
5 bore having a sidewall for laterally supporting the connecting rod during reciprocation of the piston.

Preferably, the engine includes an even number of the cylinders, regularly circumferentially spaced around the periphery of the engine block.



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In another embodiment, the walls define a projecting ridge on each plate, which in turn define the loop, and the cam follower includes channels into which the ridges extend, the follower being configured to traverse the ridges to rotate the plates.

BRIEF DESCRIPTION OF THE DRAWINGS

5 Preferred embodiments of the invention will now be described by way of example only, with reference to the accompanying drawings in which:

Figure 1 is a side elevation of an engine according to an embodiment of the present invention;

Figure 2 is an elevation of the engine of Figure 1 in the direction of arrow II;

10 Figure 3 is a side elevation of an engine block of the engine of Figure 1;

Figure 4 is an elevation of the block of Figure 3 in the direction of arrow IV;

Figure 5 is a side elevation of an engine block cover forming part of the engine of Figure 1;

Figure 6 is an elevation of the cover of Figure 5 in the direction of arrow VI;

15 Figure 7 is a side elevation of a further engine block cover forming part of the engine of Figure 1;

Figure 8 is an elevation of the cover of Figure 7 in the direction of arrow VIII;

Figure 9 is a side elevation of part of a crank forming part of the engine of Figure 1;

20 Figure 10 is an elevation of the part of Figure 9 in the direction of arrow X;

Figures 11 and 12, 13 and 14, 15 and 16, and 17 and 18, are side elevations and end elevations, respectively, of various components of the engine of Figure 1;

Figure 19 is a part-exploded perspective view of another embodiment of an engine according to the invention;

25 Figure 20 is a perspective view of the engine of Figure 19, shown with the cam plates removed; and

Figure 21 is a perspective view of the linear slider bearing of Figures 19 and 20.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

30 Referring to Figures 1 to 18 of the drawings and according to a first embodiment of the invention, a radial engine 1 includes an engine block 2 with a circular recess 3 on each side of the block, and a web 4 dividing the recesses. Each one of a pair of cam plates 6 and 7 is supported on a cylindrical shaft 8 (see especially Figures 11 and 12) for

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THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

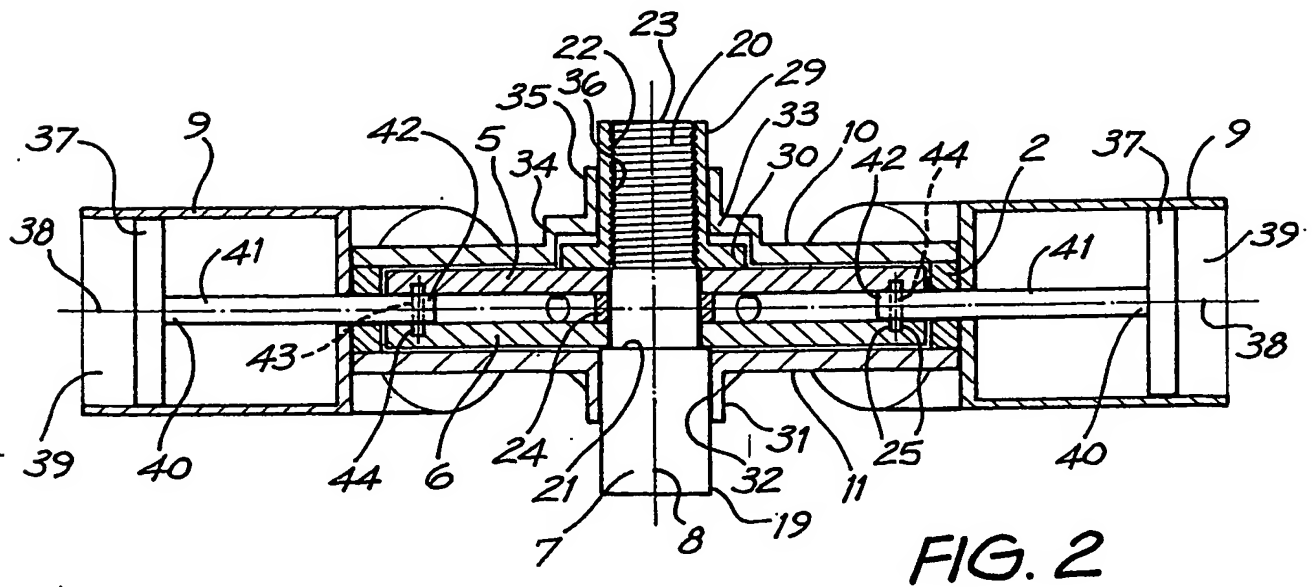
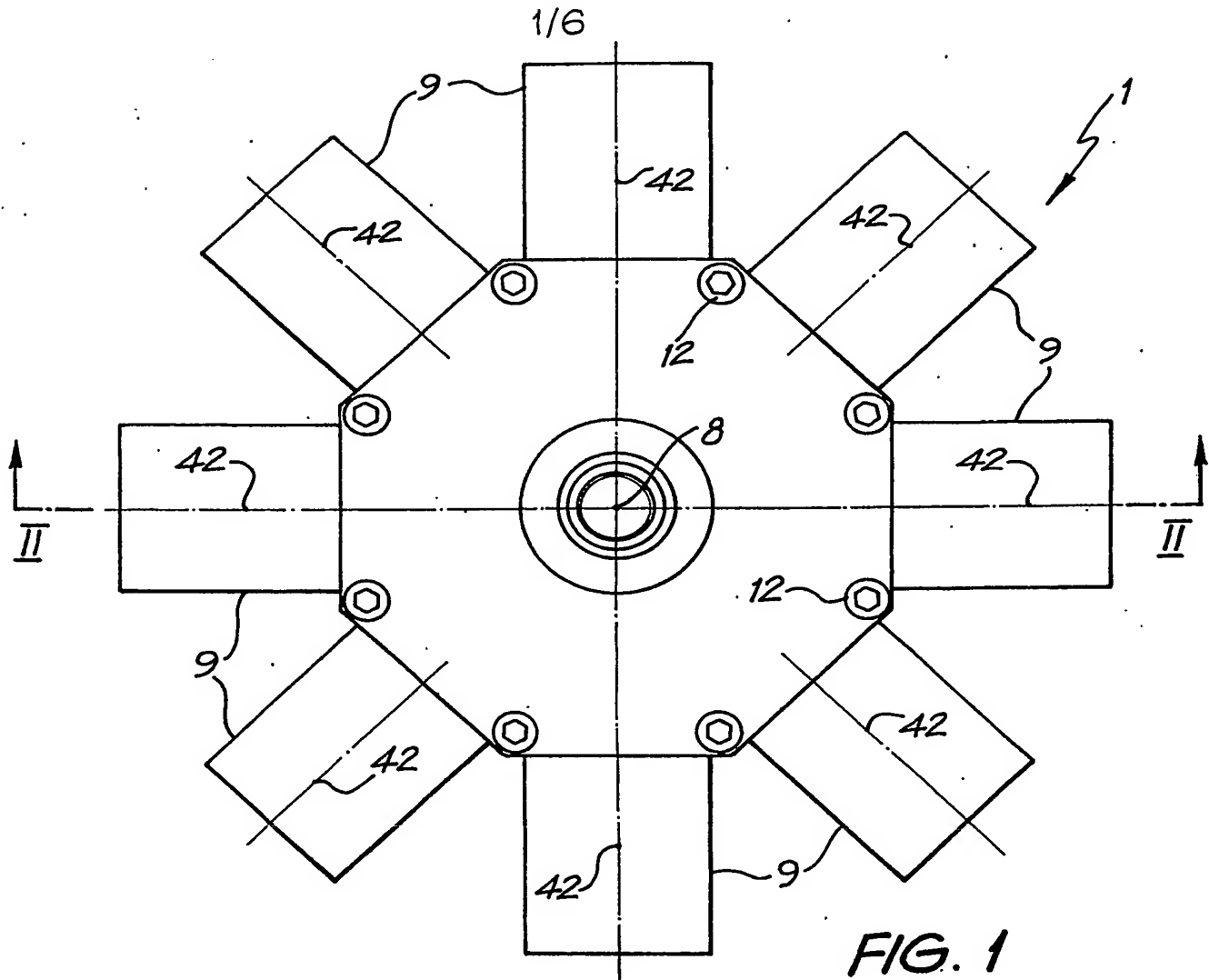
1. A radial engine including:
 - an engine block having a central aperture;
 - a drive shaft extending through said aperture;
 - 5 a spaced pair of cam plates rotationally fixed with respect to each other, the plates being fixedly mounted on said shaft;
 - each cam plate including a planar face, the planar face of one cam plate opposing the planar face of the other cam plate;
 - the opposing faces each including a pair of spaced opposing walls defining a
 - 10 substantially "figure 8" shaped continuous loop, the walls on one said face being aligned with the walls on the opposing face;
 - at least one cylinder fixed with respect to said block and extending outwardly from said block;
 - a reciprocable piston slidably mounted within said cylinder;
 - 15 a connecting rod fixedly connected at one end to said piston and having an opposing free end;
 - a slider bearing located on said free end of said connecting rod, said slider bearing engaging with a guide for guiding said slider bearing during reciprocation of said piston; and
 - 20 a cam follower engaged with said walls of each cam plate, wherein reciprocation of said piston rotates said plates and said drive shaft.
2. A radial engine as claimed in claim 1 wherein said guide is defined by a radially extending bore in said engine block and sidewalls of said bore laterally support said slider bearing during reciprocation of said piston.
- 25 3. A radial engine as claimed in claim 1 or 2 wherein said slider bearing includes a prismatic body.
4. A radial engine as claimed in any one of the preceding claims wherein said cam follower is located on said slider bearing.
5. A radial engine as claimed in any one of the preceding claims wherein said cam
- 30 follower is a pin.
6. A radial engine as claimed in claim 5 wherein each said substantially "figure 8" shaped continuous loop is defined by a groove in each said plate and said cam follower projects into each said groove.

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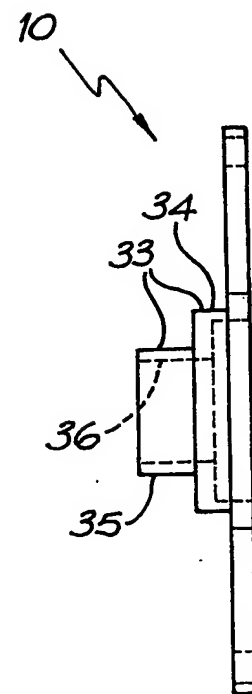
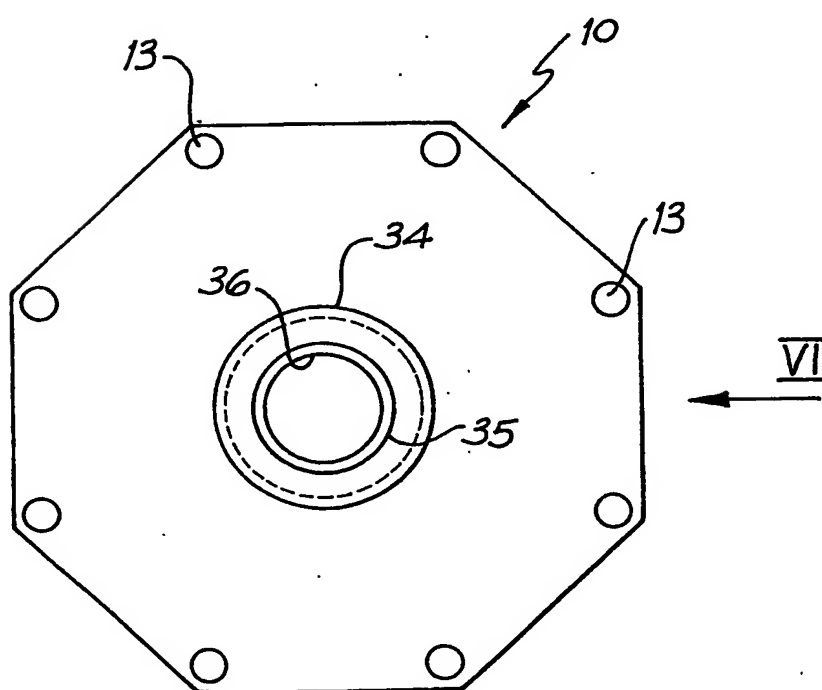
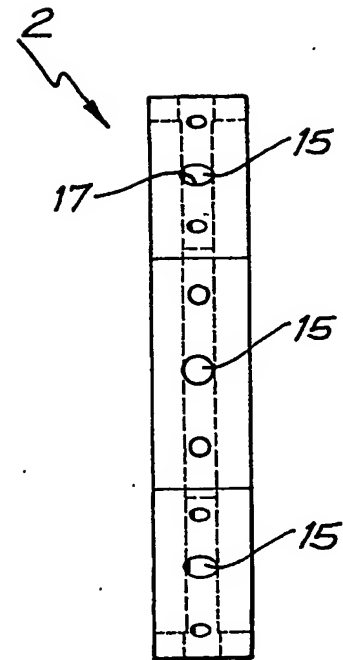
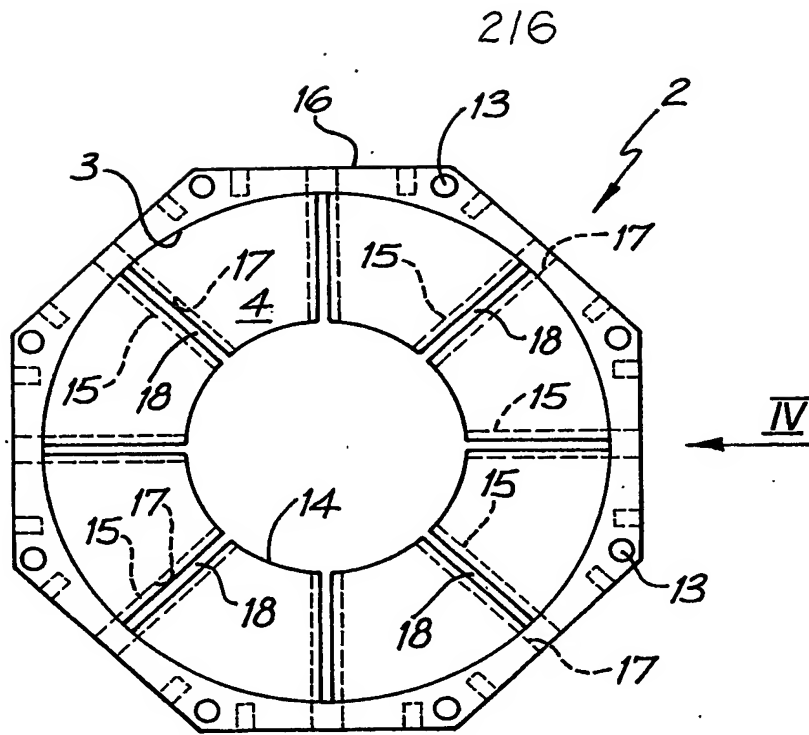
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6. A radial engine according to any one of the preceding claims further including a guide for translationally guiding said connecting rod.
7. A radial engine as claimed in claim 6 wherein said guide is defined by a complementary bore in said engine block and the sidewall of said bore laterally supports said connecting rod during reciprocation of said piston.
8. A radial engine as claimed in claim 7 wherein said sidewall includes a longitudinal slot through which said cam follower projects.
9. A radial engine as claimed in any one of the preceding claims, wherein said cam follower includes a roller for rolling engagement with said walls.
- 10 10. A radial engine as claimed in claim 1 wherein said walls define a continuous projecting ridge on each plate defining said loop and said cam follower includes channels into which the ridges extends, the follower being configured to traverse the ridges to rotate the plates.
11. A radial engine as claimed in any one of the preceding claims, including a plurality of said cylinders.
12. A radial engine as claimed in claim 11 including an even number of said cylinders, regularly circumferentially spaced around the periphery of said engine block.
13. A radial engine substantially as herein described with reference to any one of the accompanying drawings.

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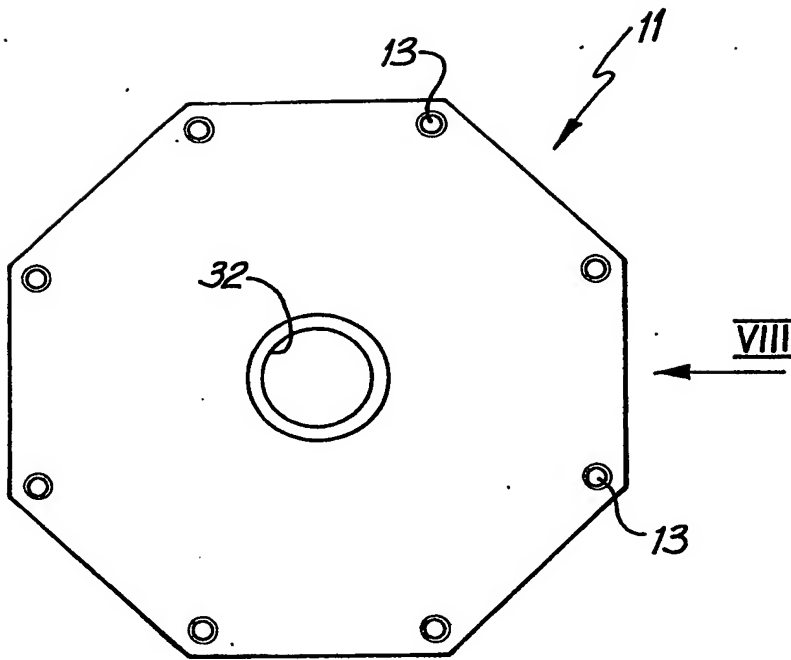


FIG. 7

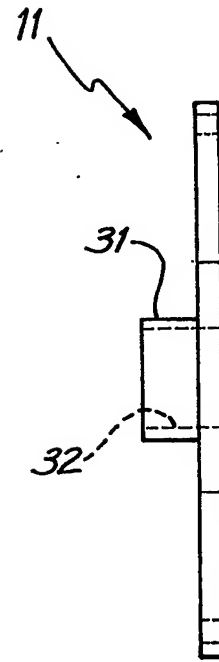


FIG. 8

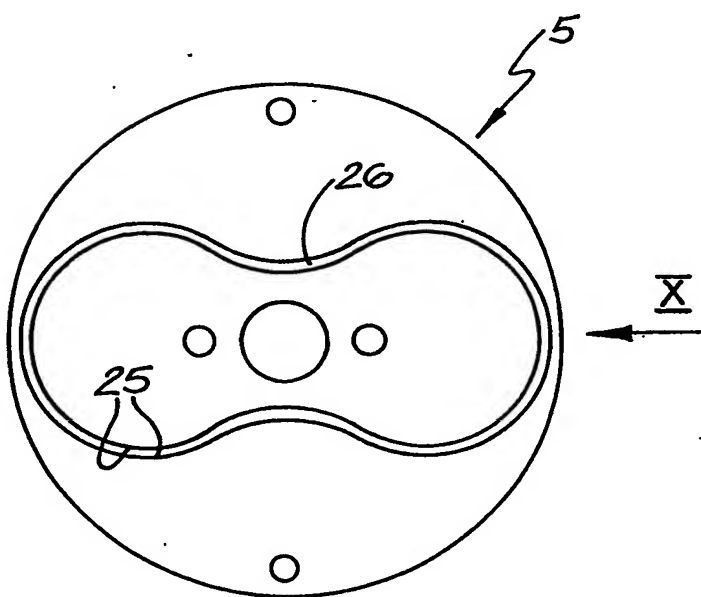


FIG. 9

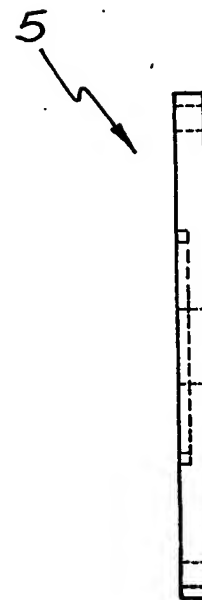


FIG. 10

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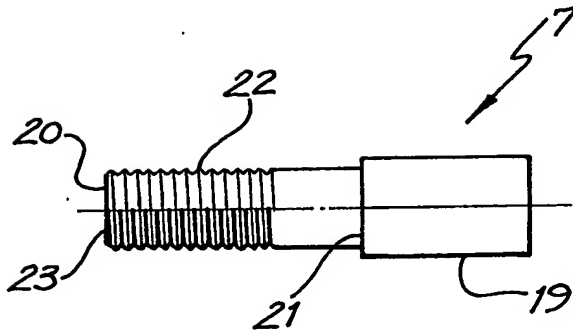


FIG. 11

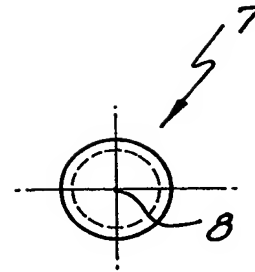


FIG. 12

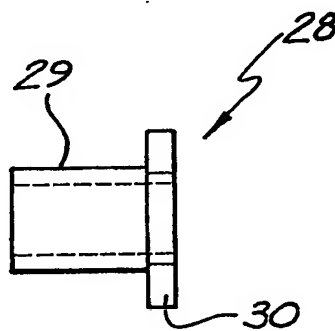


FIG. 13

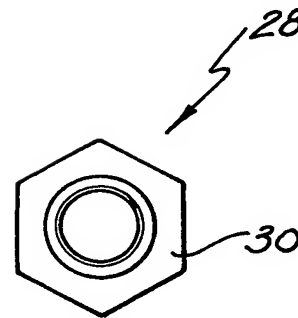


FIG. 14

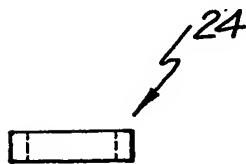


FIG. 15

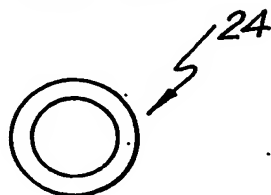


FIG. 16

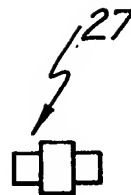


FIG. 17

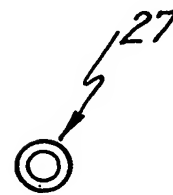


FIG. 18

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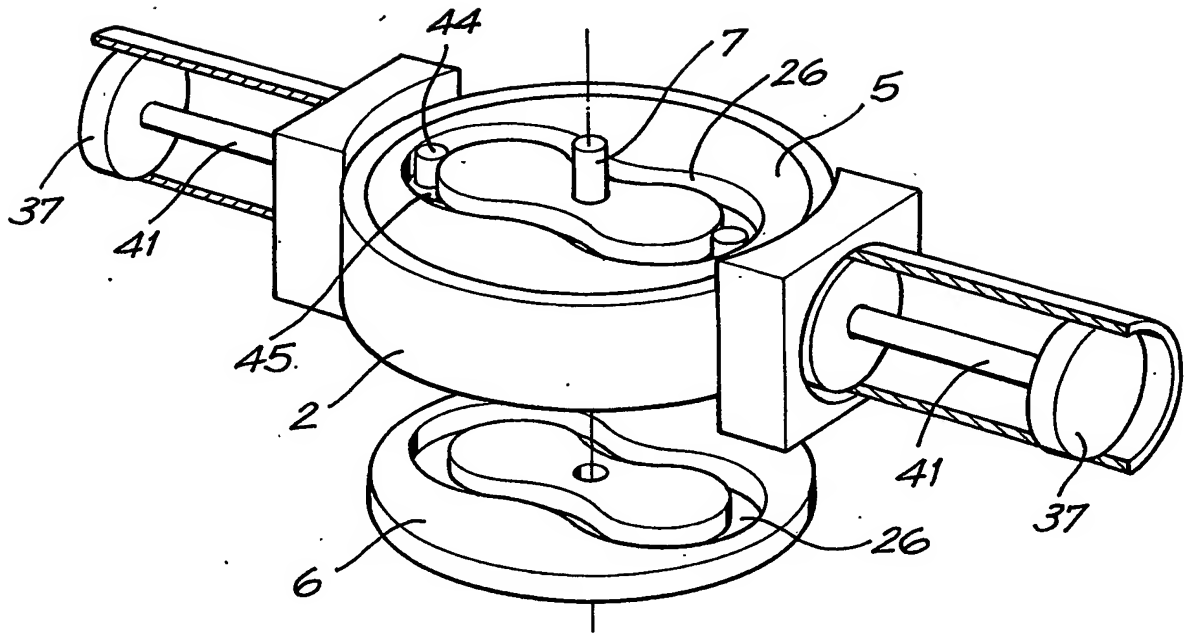


FIG. 19

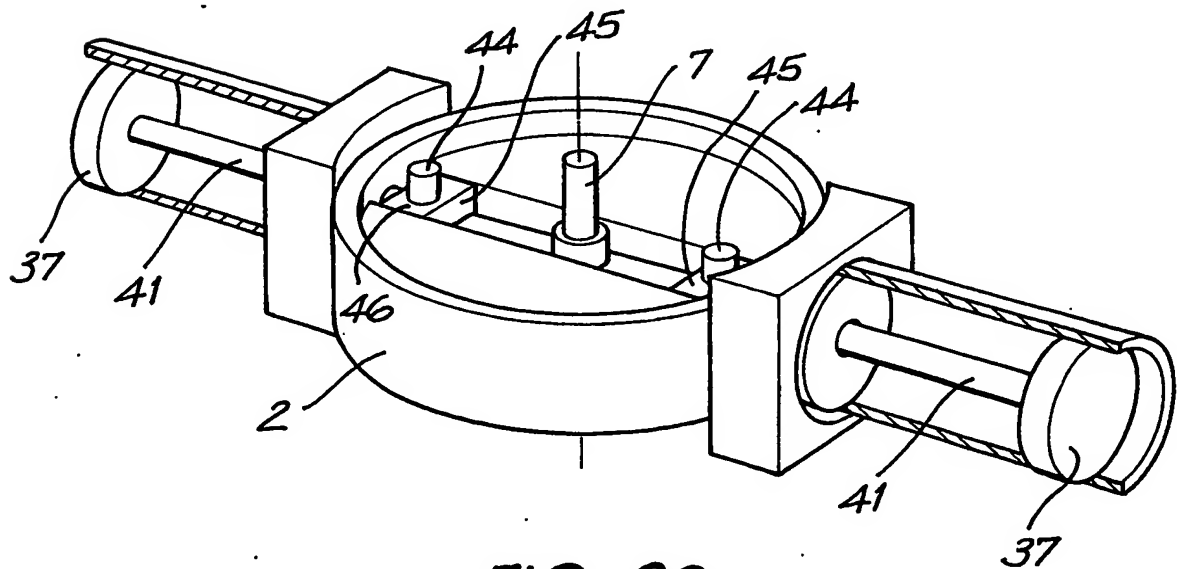


FIG. 20

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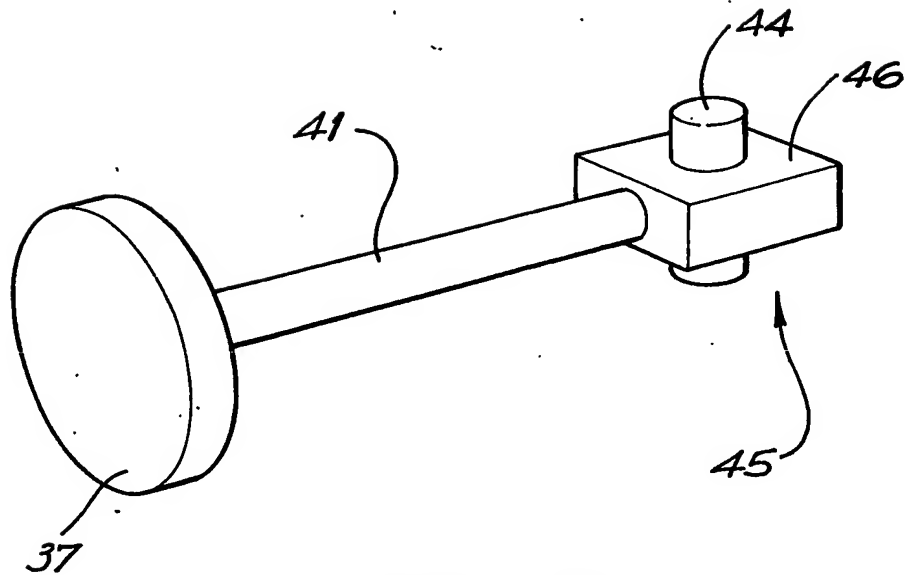


FIG. 21